Male Circumcision under Local Anaesthesia

Supplement: Diathermy and Service Efficiency

World Health Organization
UNAIDS
JOINT UNITED NATIONS PROGRAMME ON HIV/AIDS
UNHCR UNICEF WFP UNDP UNFPA UNODC ILO UNESCO WHO WORLD BANK
USAID
FROM THE AMERICAN PEOPLE
MCHIP
Maternal and Child Health Integrated Program
innovating to save lives
Jhpiego
an affiliate of Johns Hopkins University

TABLE OF CONTENTS

Section: Use of Diathermy for Male Circumcision

Learning Objectives 1
Definition 1
Basic Principles of Diathermy 1
Surgical Effects of Diathermy 1
Monopolar and Bipolar Diathermy Circuits 2
Potential Advantages 3
Risks and Complication 3
Module Summary 6

Section: Efficiency in Male Circumcision Service Delivery

Learning Objectives 7
Introduction 7
Demand Creation and Counseling and Testing 8
Clinical and Surgical Techniques 8
Haemostasis by Diathermy 9
Hand Hygiene between MC Cases: 9
Task Shifting and Task Sharing 9
Efficient Use of Facility Space: Conventional and Modified Surgical Approaches 10
Client Scheduling and Flow 12
Commodities Management and Supply Chain Management System 13
Bundling of MC Commodities 13
Clinical Success Factors to Address Efficiency 14
Module Summary 14

SECTION: USE OF DIATHERMY FOR MALE CIRCUMCISION

LEARNING OBJECTIVES

- Define diathermy
- Discuss the basic principles of diathermy
- Describe monopolar and bipolar diathermy
- List the benefits and risks of using diathermy
- List the "dos" and "don'ts" of using diathermy

DEFINITION

Diathermy is the use of high-frequency alternating current to produce heat. The name diathermy is derived from the Greek words *dia* (through) and *therme* (heat). The heat produced within tissues causes coagulation of bleeding vessels and also cuts through tissues. Diathermy is therefore used for different surgical interventions ranging from minor procedures (e.g., male circumcision) to major procedures (e.g., transurethral resection of the prostate (TURP).

Basic Principles of Diathermy

High-frequency alternating current (HFAC) is passed through the body, producing heat within tissues to coagulate bleeding vessels and cut through tissue. Main electricity supply of 240v/ 50 or 60 Hz produces intense muscle and nerve activation, resulting in painful muscular contractions and shock. When this normal, alternating current passes through a diathermy machine, it is converted to HFAC ranging from 300 kHz to 3 MHz, which produces minimal or no effects on muscles and nerves.

Surgical Effects of Diathermy

Coagulation: The heating effect dries out cells in the wall of the blood vessels and they contract, which results in haemostastatic function of diathermy. Even though diathermy is used to coagulate blood vessels to stop bleeding, its use should be limited to vessels with a diameter of 5 mm and below. All vessels larger than 5 mm diameter should be ligated.

Cutting: A high quantity of heat is generated between the electrode and the tissue, which vaporizes the body cells.

Fulguration: In this mode, very high voltage/power is used to produce an electrical arc effect that causes skin charring or carbonization. These effects are seen over a wide area when operating in contact with a probe. Hence, its application is for very superficial or protrusive lesions such as skin tags and to destroy growths in the rectum or bladder. Fulguration has **NO** application in MC surgery.

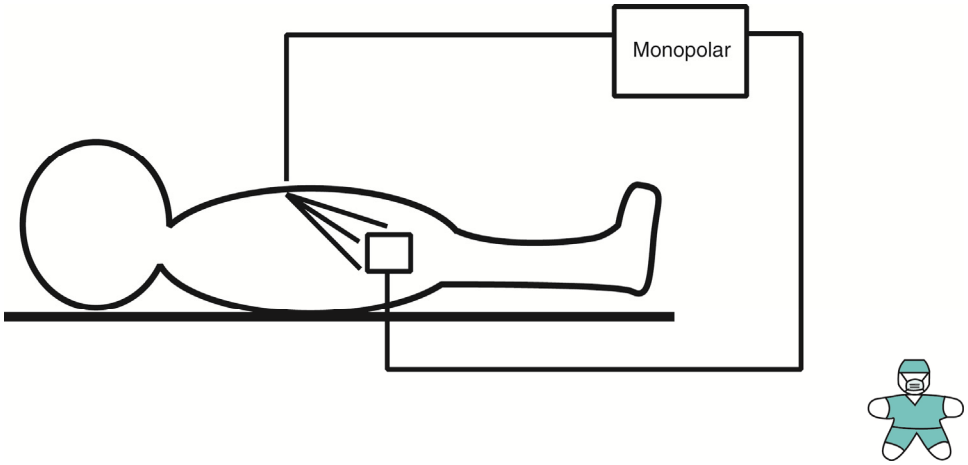
Monopolar and Bipolar Diathermy Circuits

There are several electrode configurations or combinations. Commonly in surgical practice, we use monopolar and bipolar configurations.

Monopolar Diathermy:
With monopolar diathermy, the current runs from the machine through a diathermy forceps, through the tissue held by the forceps, then through the patient's body to a grounding plate placed elsewhere on the body, and then back to the machine.

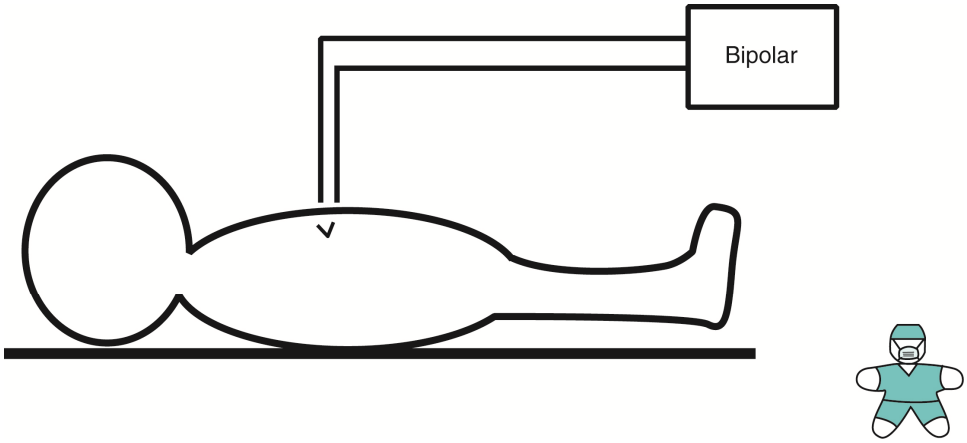
Only one side of the generator output is connected to the active electrode or surgical instrument, which may take different shapes (blade, loop, ball or needle). The heating effect is inversely proportional to the surface area of the electrode; therefore, the smaller the electrode the larger the diathermy effect. The other side of the generator output is connected to a large patient plate. This plate can be either reusable or disposable These plates may be placed on body parts that have a relatively bigger bulk of tissue and are adequately vascularized such as the buttocks, abdomen, posterior aspect of the thigh and mid and lower back. The plates should have full contact with the skin and be placed on the same side of the body and close to the body parts where the procedure is occurring.

Figure 1. Monopolar Circuit



Bipolar Diathermy:
In bipolar diathermy, the current runs from the machine to one of the two prongs of a diathermy forceps, through the tissue grasped between the prongs and then back to the machine through the other prong. The use of the bipolar configuration does not require the use of plates, because the current does not flow through the body of the patient/client.

Figure2. Bipolar Circuit



Potential Advantages

- The greatest benefit of using diathermy in male circumcision is the significantly reduced procedure time.
- Potentially, there are savings on the cost of sutures in the long term.
- Fewer instruments are used, reducing the cost of reprocessing.

Risks and Complication

- Can interfere with pacemaker functions
- Arcing can occur with metal instruments and implants
- Superficial burns if used with alcohol-based skin preparation
- Burns, if plate is not properly applied
- Channeling effect if used on viscous with narrow pedicle, e.g., penis, testis. Monopolar diathermy should not be used for infant circumcision because the point of maximal electrical resistance may be at the base of the penis, particularly if the penis is under any traction, with risk of coagulation and loss of the whole penis.

Precautions

- Care has to be taken to ensure that the patient is not in contact with any metal or conducting material as there is a risk of earth leakage and burns at the point of contact with the conducting material. This risk is greatest with monopolar diathermy but whenever diathermy is used, care must be taken in positioning on the operating table, the choice of operating tables and clinic construction to prevent leakage of current to earth. More sophisticated monopolar diathermy machines have safety features incorporated in their design, and include automatic switch-off if there are any of the following faults: earth leakage, disconnected grounding plate or poor contact between the grounding plate and skin.
- The grounding plate should be placed so that there is a broad area of contact between the plate and the patient's skin. Sometimes it is necessary to shave hairs to ensure good contact.
- If the machine fails to respond when the surgeon activates the current or there is no obvious and immediate visual evidence of coagulation, the surgeon should immediately stop applying the current and check all connections and the grounding plate. If the surgeon continues to apply current, burns may occur where resistance is greatest. This is most commonly where the grounding plate is in contact with the body, or where the body is in contact with metal. In rare circumstances, the burn may occur elsewhere in the body.

Diathermy Tip:

- When using diathermy, the surgeon should apply the forceps as precisely as possible. The best results will be obtained if the blood vessel is between the diathermy prongs with minimal other tissue, and the current activated for the shortest time needed to ensure haemostasis. If too much tissue is grasped, diathermy will not stop the bleeding because the burn is too diffuse.
- Prolonged diathermy causing large black burns should be avoided as these may result in infection, increased postoperative pain and scar tissue formation.
- Particular care must be taken near the frenulum because the urethra is near to the surface and there is a risk of creating a fistula by burning through to the urethra.
- Diathermy should also be used with caution close to the skin and mucosal edges as transmitted heat may cause burns.

- Diathermy can be used to stop bleeding from small blood vessels, but for larger vessels, it is safer to apply an artery forceps and tie or under-run as described above.

"DOS" AND "DON'TS"
• The diathermy unit should be protected from spills. • The dispersive electrode should be the appropriate size for the patient's weight. • An electrode should never be cut to size (minimum surface area to avoid overheating is **69 sq cm**). • Only those active electrodes recommended by the manufacturer should be used. • After the patient is positioned on the operating table, the dispersive electrode should be placed on a clean, dry, intact skin surface over a large, well-perfused muscle mass. • The dispersive electrode should not be placed over: – Bony prominences – An implanted metal prosthesis – Areas distal to a tourniquets – Scar tissue – Hairy surfaces • The electrode should be positioned as close to the operative site as possible. • The dispersive electrode should be connected to the diathermy unit prior to draping to ensure adequate contact. • The dispersive electrode and its connection to the diathermy unit should be checked if: • Any tension is applied to the dispersive electrode cable. • The surgical team repositions the patient's pressure points/areas. • The dispersive electrode cable should not be wrapped around metal objects. • Incomplete adhesion of a dispersive electrode may be caused by moisture. • Dispersive electrodes that have been removed from a patient's skin should be discarded or cleaned. • A new dispersive plate should be used if repositioning is required. • Dispersive electrodes should not be used on children suffering from epidermolysis bullosa. • The power setting should be confirmed verbally between the operator and the user before activation. • The power settings are determined in conjunction with the manufacturer's written recommendations, patient size and type of procedure. • It is the responsibility of the surgeon to activate the active electrode. • Check the entire diathermy unit circuit if the operator requests continual increase in power to identify any incomplete circuitry. • The active electrode should be disconnected from the diathermy unit and replaced if it drops below the sterile field. • The active electrode tip should be easy to clean, securely placed and be single-use. • When not in use, the active electrode should be placed in a clean, well-insulated holster. • Following the completion of the surgery, the single-use active electrode tip should be discarded into a sharps bin. • The dispersive electrode should be removed carefully to avoid denuding the surface of the skin. • The patient's skin integrity should be evaluated and documented before and after diathermy unit use. • Following removal of the electrode, if the skin appears to be damaged, appropriate adverse events procedure should apply.

MODULE SUMMARY

- Employment of efficiency principles in all of the service delivery models aims to maximize the numbers of MCs while maintaining quality.
- Task shifting, task sharing, appropriate choice of the surgical method, enabling layouts of service sites, and use of diathermy and surgical kits are key strategies for enhancing efficiency in MC services.
- The male circumcision techniques described in this reference manual can all be undertaken safely without diathermy equipment, and any surgeon undertaking male circumcision should be adept at stopping bleeding with or without diathermy.
- Diathermy has the advantage of decreasing haemostasis time during surgery, thereby shortening the procedure time.
- Diathermy used by a well-trained provider is a useful, safe and time-saving tool.

SECTION: EFFICIENCY IN MALE CIRCUMCISION SERVICE DELIVERY

LEARNING OBJECTIVES

- Discuss the rationale for adopting efficient models of providing MC services
- List different considerations/models for efficient MC service delivery
- Explain key strategies to increase efficiency in MC services

INTRODUCTION

Improving the efficiency of health care delivery has been the epicenter for many developing and developed countries especially after primary health care was endorsed as a strategy for service delivery in 1978.[1] Efficient health care assures that resources are used appropriately, target audiences are served equally and equitably, and impacts of services are maximized at both the individual and public level. This topic has become especially critical for programs reaching a significant number of men for circumcision in a short period of time. Improving efficiency has the benefits of allowing greater public health impact with a tremendous reduction in service cost. All the models show that rapid expansion of male circumcision coverage will result in earlier and larger effects on HIV incidence. An expert review group concluded that rapid initial scale-up produces direct and indirect effects earlier and is considerably more cost-effective, with fewer circumcisions required to avert one infection and more infections averted at a lower cost per infection averted over time.

Reaching 80% circumcision prevalence in southern and eastern Africa in the coming 3–5 years requires that health authorities, service delivery sites and service providers have a different service provision orientation that assures a high number of circumcisions is performed using existing number of providers, without compromising quality.

As programme managers undertake implementation and scale-up of MC services, they will need to consider a range of factors that will impact efficiency and productivity. In male circumcision to prevent HIV/AIDS, these factors include:

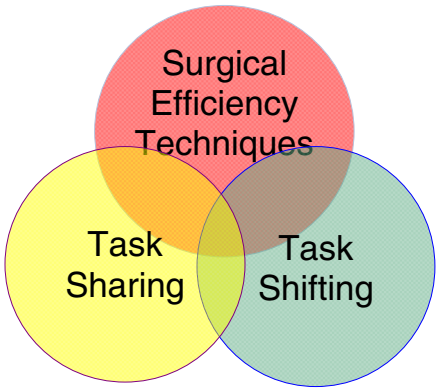
- Demand creation, counseling and testing

[1] International Conference on Primary Health Care, Alma-Ata, USSR, 6–12 September 1978. At: http://www.who.int/hpr/NPH/docs/declaration_almaata.pdf.

- Clinical and surgical techniques
- Efficient use of staff and training
- Efficient use of facility space
- Client scheduling and flow
- Commodities and supply chain management
- Cost efficiency

DEMAND CREATION AND COUNSELING AND TESTING

The service provision in clinical sites is very much dependent on a well-planned client flow from the community to access these services. Currently, programmes are looking at different approaches for increasing awareness about services and inducing service seeking using different approaches. Communication strategies and approaches (by PSI) and collaboration with community service organizations (by Jhpiego Tanzania) are two examples. Male circumcision is primarily performed for the purpose of HIV prevention, making counselling and testing a key component and entry point for the service. However, providing counselling and testing for a large number of clients has presented itself as a rate limiting in scale-up so far. Innovating approaches to overcome this challenge is becoming more important than it has ever been.



CLINICAL AND SURGICAL TECHNIQUES

Surgical techniques: As discussed in Module 5, three surgical techniques are widely used for adults/adolescent MC: **forceps guided, dorsal slit and sleeve resection**. These techniques are generally equivalent in terms of safety but vary in the time required to complete the procedure. In some countries, programme reports suggested that forceps guided is the fastest compared to the dorsal and/or sleeve techniques. As MC services are scaled up, operations research will need to evaluate these surgical techniques to ensure that safety is

maintained while efficiency is improved. While more specialized providers are encouraged to be proficient in their preferred method, scale-up and task sharing benefit from standardizing the circumcision method.

Table 1. Sample comparison of different surgical methods for circumcision[2]

INDICATOR	FORCEPS GUIDED	DORSAL SLITS	SLEEVE
Surgeon time (minutes)	6.20	8.45	14.0
Total procedure time (minutes)	19.20	21.45	27.00

Haemostasis by Diathermy

Haemostasis by diathermy—stopping the flow of blood by using a machine with a high-frequency electrical current that produces coagulation—is the standard of care for penile surgery in the United States. Reports of harm are rare; however, training of staff is important. It is especially important to ensure that the client is grounded properly and that the machines are modern and do not transmit surges. (*Review section: Use and Care for Diathermy)*

Hand Hygiene between MC Cases:

In most clinical settings, an alcohol-based handrub should be used for routine hand antisepsis. Hands should be washed or treated with a handrub:

- Before and after direct contact with clients
- After removing gloves
- Before handling an invasive device for client care (whether or not gloves are used)
- After contact with blood, blood products, body fluids or excretions, mucous membranes, non-intact skin or wound dressings
- After using the toilet (normal personal hygiene)

Task Shifting and Task Sharing

Main MC surgical steps:

- Examination of the genitalia
- Surgical site preparation
- Injection of local anaesthesia

[2] Samkange C. 2009.

- Marking
- Placement of forceps (except for sleeve technique)
- Surgical removal of skin
- Haemostasis (stopping the bleeding)
- Placement of mattress sutures
- Placement of simple interrupted sutures
- Dressing of surgical wound

A surgeon does not need to perform all of the main steps in MC surgery (listed above). To increase the efficiency of MC service delivery, some of these steps can be shared or shifted. Decisions about which steps are shared and which are shifted will need to be made based on staff realities, national laws/regulations, and individual skills.

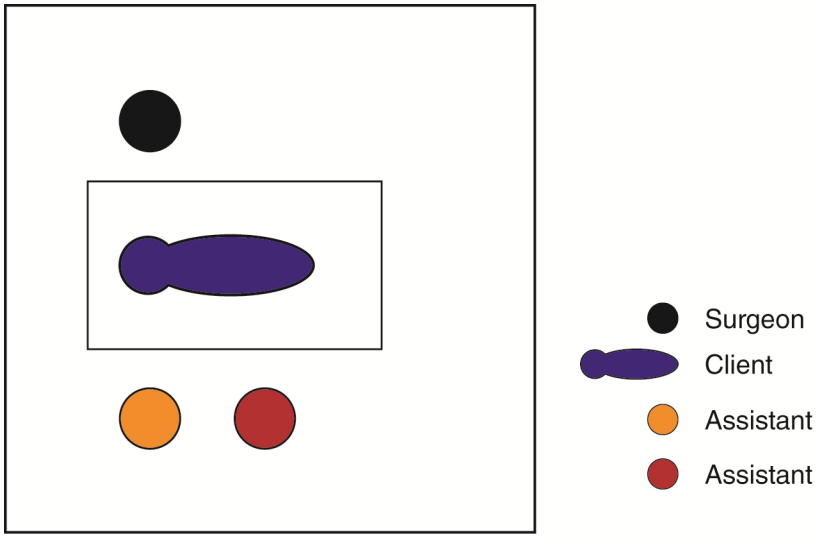
Task shifting, or shifting tasks from doctors to clinical officers and nurses = Use of highly trained non-physician providers to complete all steps of MC surgery.

Task sharing = Assigning less complex tasks to lower credentialed but highly trained health care cadres. For both task shifting and task sharing, a highly experienced provider must supervise and mentor the less experienced providers so that risks to the MC client are minimized.

EFFICIENT USE OF FACILITY SPACE: CONVENTIONAL AND MODIFIED SURGICAL APPROACHES

In the conventional surgical approach (below), typically one surgeon/circumcision provider, assisted by one nurse, performs all steps of the MC procedure for one client. One surgeon/circumcision provider working with one assistant only allows an average of eight to 10 MCs per day.

Figure 3. Conventional Surgical Setup

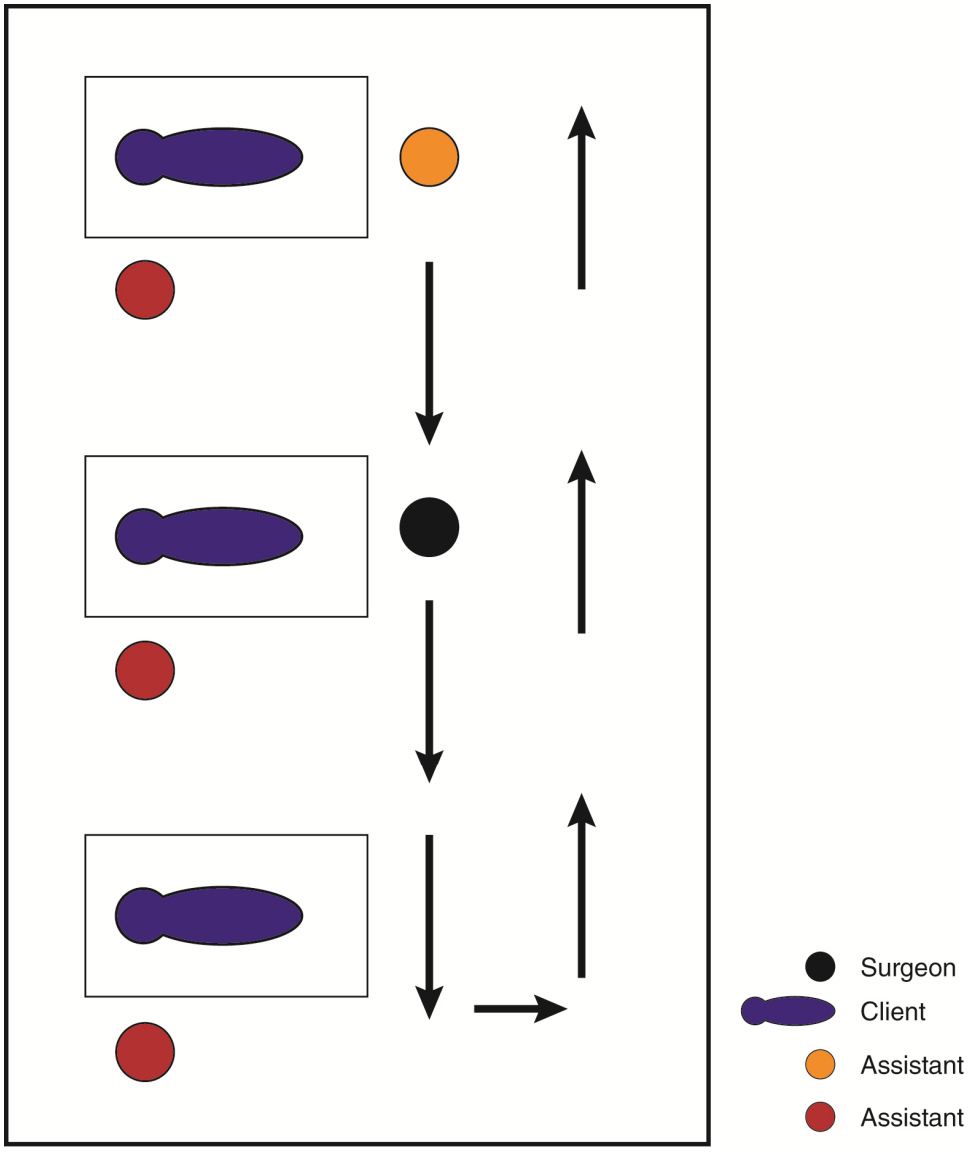


This conventional surgical layout and staff-to-client ratio can be modified to support task sharing and task shifting in the context of rapid scale-up of MC services.

In the modified model:

- Four MCs are performed simultaneously
- A **team** of providers does the procedures.
- Floor space is laid out as four surgical bays that are separated for privacy.
- A single **surgeon** moves from bay to bay, removing the foreskin and performing mattress suturing for each of four MC clients.
- A single **float nurse** moves from bay to bay, administering anaesthesia and doing simple sutures for each of the four MC clients.
- Four **surgical bay nurses**, one assigned to each bay, remain in place to prep, drape, and assist in surgery for a single MC client.

Figure 4. Modified Use of Surgical Space



CLIENT SCHEDULING AND FLOW

Client scheduling has a major impact on efficiency. For some communities and facilities, *segment booking* may work better than *individual booking*. In communities where individual appointments are frequently not kept, efficiency may be severely hampered by periods of minimum activity that are followed by periods of overwhelming catch-up. To save staff and client time, the work day can be divided into segments (e.g., three segments of 3 ½ hours each). Clients can be booked for a specific segment and asked to arrive at the starting time for that segment. Using segment booking, the client's waiting time would usually be a maximum of the duration of the segment (i.e., 3 ½ hours). **Segment booking is preferable to mass daily booking (in which clients are asked to all come at the same time at a particular time of the day.)**

Client flow should be coordinated through the facility to avoid congestion and confusion and save client and staff time. Client flow should:

- Provide easy access to separate entry and exit points at opposite ends of the clinic (ideally).
- Provide a recovery area close to the exit where clients can rest and be monitored, as needed.
- Provide an area near the exit point where the client can be given, in privacy: postoperative counselling, an information leaflet about postoperative instructions and complications, and a follow-up appointment.
- Minimize client contact with hazardous surgical waste.

COMMODITIES MANAGEMENT AND SUPPLY CHAIN MANAGEMENT SYSTEM

The effectiveness of MC programmes will depend on a **strong supply chain management system** that can ensure that the appropriate commodities and equipment are consistently available. The following **key components of supply chain management** will need to be in place:

- Forecasting: continuous anticipation of future MC supply needs
- Procurement: an efficient system for obtaining MC commodities bundled into sterilized sets/packs/kits
- Distribution: getting MC supplies where they are needed, on time, in multiple locations and settings
- Storage: ensuring the quality and safety of MC commodities, and their packaging, while making them available for distribution
- Stock in hand: keeping track of the quantities of usable MC commodities that are currently available at the MC service delivery site (excluding items that are expired or no longer usable)
- Disposal management: ensuring that protocols for safe handling and disposal of waste are established and practiced at the MC service delivery site, with special attention given to handling and disposal of biohazardous and infectious wastes (e.g., MC commodities soiled with blood and body fluids)

BUNDLING OF MC COMMODITIES

Commodities needed to perform a single MC may be disposable or reusable. They vary by surgical technique and whether or not diathermy is used. Bundling of these commodities contributes to improved efficiency. **It is**

important to bundle all MC commodities and equipment well in advance of the scheduled procedures. MC commodities may be bundled as follows:

- **Consumables pack:** Bundled consumable materials (e.g., gauze, needles, scalpel blade and gloves) used in an MC operation and then discarded.
- **Instrument set:** Bundled surgical instruments used in an MC operation (may be disposable or reusable).
- **MC kit:** Combination of consumables pack and an instrument set. (An MC kit is needed for each MC operation.)
- Module: Bundled supplies used for infection prevention, furnishing operating theatres and managing emergency medical situations. (These items may be disposable or reusable.)

CLINICAL SUCCESS FACTORS TO ADDRESS EFFICIENCY

New service delivery models designed to address efficiency will not work unless the clinical teams who do the work **buy in** to the new processes. Clinical team leaders need to be sensitized **to efficient programmes** so that they can encourage and promote the **mind set changes** that are needed to implement new service delivery models for increased efficiency.

Overall, the success in clinical service delivery is not going to be an isolated event. "Systems thinking" needs to happen. Systems thinking needs the disciplines of building shared vision, mental models, team learning, and personal mastery to realize its potential. Building shared vision fosters a commitment to the long-term or public benefit. Mental models focus on the openness needed to uncover shortcomings in our present ways of providing services. Team learning develops the skills of groups of people to look for the larger picture beyond individual perspectives. And personal mastery fosters the personal motivation to continually learn how our actions affect our work and efficiency.[3]

MODULE SUMMARY

- Male circumcision scale-up will require significant investment in human, material and financial resources.
- It is necessary to rationalize the use and time of available health personnel in order to achieve the desired impact of male circumcision scale-up.
- Different service delivery models, including conventional, fixed and mobile, will need to be employed to reach the set targets.

[3] Senge PM. 1990. *The Fifth Discipline: The Art and Practice of the Learning Organization.* Doubleday: New York.

- Employment of MOVE principles in all of the service delivery models aims to maximize numbers of MCs while maintaining quality.
- Task shifting, task sharing, appropriate choice of the surgical method, enabling layouts of service sites, and use of diathermy and surgical kits are key strategies for enhancing efficiency in MC services.